# Establishing a Pecan Orchard

Becky Carroll
Senior Agriculturist

Michael W. Smith
Research Horticulturist

Oklahoma Cooperative Extension Fact Sheets are also available on our website at:
**http://osufacts.okstate.edu**

The decision to establish a pecan orchard should be studied carefully, due to the long-term investment and extensive management strategies involved in pecan production. A well-planned, organized orchard will prove to be more efficient by requiring less inputs and offering larger potential returns.

In Oklahoma, the main pecan production is from native trees. However, several benefits are associated with planted orchards. Either cultivars or seedlings may be selected, depending on the grower's goals. Straight rows in planted orchards facilitate maintenance, irrigation and harvest. In addition, tree growth and spacing requirements can be anticipated, as well as planning for tree thinning.

## Choosing the Location

Because of the permanent nature of pecans, choosing the orchard location is extremely important. Both soil characteristics and geographical location of the orchard may determine the success of the planting. Evaluate the site carefully before deciding to plant an orchard. Proper site preparation should begin at least a year in advance, if possible.

## Soil

- Start with the county soil survey map. Most of these can be found online at http://www.nrcs.usda.gov/wps/portal/nrcs/soilsurvey/soils/survey/state/, or contact the local county Extension office or Soil Conservation Service. Detailed information will include soil texture, depth, water infiltration rates, water holding capacity, fertility, drainage, slope and other characteristics.
- Although soil survey maps are a great place to start, it is best to evaluate in person. Dig some holes and look at soil depths and layers, as well as any limiting factors, such as rock or high water tables.
- Native pecans are typically found growing in deep alluvial soils along rivers and streams. These alluvial soils are good for pecan production, but uplands with deep well-drained soils and proper management also can be productive. Observe existing vegetation and trees for an overall observation of soil health.
- Soils should have at least 36 inches of soil with good aeration.
- The soil should also have the ability to hold large quantities of water. A permeable clayey subsoil can aid in water-holding capacity without waterlogging the rooting zone. Light textured sandy soils with low water-holding capacity will require irrigation for consistent pecan production.
- The water table during wet periods should remain at least 5 feet below the soil surface. Shallow water tables limit rooting zones, which in turn limit available water during prolonged droughts.

## Irrigation Water

- Pecans require large quantities of high-quality irrigation water during the establishment of the orchard and to produce high-quality, improved varieties pecans.
- Growers can use groundwater or surface water such as streams and lakes. Make sure to check on regulations and secure water rights with the Oklahoma Water Resources Board (https://www.owrb.ok.gov/) for surface and subsurface water before investing.
- Irrigation water should be tested for quality and sufficient quantity. Some streams and groundwater in Oklahoma is unsuitable for irrigation because of high concentrations of salts, sodium or boron. Consult your county Extension office for sample collection procedures.
- Consult an irrigation specialist to determine if there is enough water available to provide for irrigation needs. Purchase the correct size of pumps, lines and filters.
- Irrigation benefits initial tree survival and growth, but excellent vegetation control surrounding the tree is the most important cultural practice. A mulch 4 inches to 6 inches deep and 6 inches to 8 feet in diameter with wood chips or other suitable material promotes survival and growth of young trees.
- Soil type, water quality and quantity will factor into the decision of type of delivery system to install.
- An irrigation system should be able to deliver at minimum, 3,000 gallons of water per acre per day for mature trees during the summer months.

## Site

- The **terrain** should be level or gently sloping and free of areas that hold water. Pecans are more efficiently harvested and managed on nearly level ground.
- Surface **drainage** is important. Grading, ditching or clearing existing waterways will help to drain the surface water quickly after heavy rains. If water is allowed to stand in the field, waterlogging will occur. This blocks oxygen that pecan roots require to be productive. Eventually, such trees will decline in productivity and may die
- An area prone to frequent and long-term **flooding** should not be considered. Fall flooding can wash pecan crops downstream or make the orchard inaccessible for harvest. Flooding from April to June reduces the orchard's production potential. Flooding also decreases fertilizer efficiency, and interferes with pest and disease control.

- Gentle **slopes** help in air drainage. Disease problems are more problematic when windbreaks or low-lying land restricts air flow. Cold air settles in protected or low areas, making the site more prone to freeze problems in both the late fall and early spring. An area with steep slopes may cause erosion problems and increase hazards associated with mechanical operations.

## Land Preparation

1. The first step is to take a proper soil sample for nutrient-supplying ability. Fact sheet PSS 2207 - How to Collect a Good Soil Sample details the process. Contact your local county Extension educator for more information and to submit the sample for analysis. The test will determine the lime and fertilizer requirement (see Extension Fact Sheet HLA-6232, *Fertilizing Tree Fruits and Pecans*).
2. Correct any drainage problems by diverting surface water and opening up ditches for internal drainage. Assistance in planning adequate drainage can be obtained from NRCS Service Centers.
3. Remove any obstructions, trees, stumps, etc.
4. Weed control should also begin at this stage. Perennial weeds such as bermudagrass and johnsongrass should be eradicated in the tree row before planting trees. Weed competition reduces growth and survival of young trees. Vegetation-free strips managed with herbicides are necessary for newly established orchards. Fact Sheet HLA-6242, *Weed Control in Pecans, Apples, and Peaches*, discusses methods of control.
5. If an impervious zone in the soil is present, the area should be broken or considered as available rooting depth.
6. Apply lime and non-nitrogen fertilizer based on the soil test results and recommendations. Nitrogen fertilizer should be applied only as needed by the cover crop until after the trees are growing. Because phosphorus and potassium move very slowly in the soil, incorporating these before planting will provide greater accessibility to the trees. The soil pH should be 6.0 to 7.0. If necessary, apply lime and incorporate into the soil along with other pre-plant fertilizers.
7. Green manure crops improve the soil and also can be used to reduce weed problems. Summer cover crops, such as hybrid sudan grass, cow peas or mung beans and winter cover crops such as wheat, annual ryegrass or crimson clover may be utilized. After the orchard is established, a permanent sod such as fescue, white clover or native annual and perennial grasses work well.
8. Irrigation improves tree establishment and can increase productivity. Trickle irrigation, micro-sprinklers, movable or solid set sprinklers or traveling gun irrigation systems all work well for pecans. If irrigation is planned, an adequate water source and properly designed system is essential. An irrigation water quality sample should be taken before starting a pecan orchard. Often, sodium, boron or salts can be a limiting factor in the success of the orchard. The county Extension office can submit irrigation water samples for analysis. **Note:** Consult an Extension Agricultural Engineer or any other irrigation specialist before establishing an orchard.

## Selecting the Right Cultivars

There is no one best cultivar. Each recommended cultivar has both strong and weak points. At least four cultivars should be planted to ensure proper pollination and also to guard against crop failure. These cultivars should complement each other, especially in respect to times for shedding pollen. Therefore, at least two early and two late pollen-shedding cultivars should be selected. Pollinator cultivars should be within 150 feet of the cultivars to be pollinated.

The marketing program may determine the cultivars to be selected. Direct marketed pecans are usually the larger nuts, but will require more inputs to produce a well-filled kernel. Wholesale nut prices are not dependent upon size, so smaller, hardier more consistent producing cultivars may be best for this market. Prices will be less for sheller markets and less inputs are required. If irrigation is not possible, a small-nut pecan should be planted.

Disease resistance, earliness of budbreak, date of nut maturity, cold hardiness, kernel quality, bearing consistency and depredator susceptibility should be considered for each particular location. Some cultivars do better in the southern areas of the state while others do best in northern Oklahoma. For example, late-maturing cultivars may be frozen in the shuck in northern areas of the state, making them unharvestable. Cultivars susceptible to pecan scab and normally require intensive spray programs in most parts of the state may be managed with minimal fungicide sprays, if planted in the dry, southwestern regions of the state. Fact Sheet HLA-6201, *Pecan Varieties for Oklahoma*, discusses the recommended cultivars for Oklahoma. Order trees early to guarantee availability of the rootstock and variety combination.

## Designing the Orchard

Planning the orchard design is important, as it provides proper pollination, ease in operations and later aids in tree thinning. The initial tree spacing recommended is 40 feet by 40 feet. This spacing allows 27 trees per acre. Pollinator rows should be no more than eight rows apart (320 feet) and should remain in position after tree thinning. The first thinning should be initiated between 16 years and 22 years, or when more than 60 percent of the orchard floor is shaded at noon. Figure 1 shows the initial planting spacings and the subsequent thinnings. At about 25 years old to 35 years old, the final spacing should be 80 feet by 80 feet with seven trees per acre. Temporary trees that will be removed during the first thinning provide a good opportunity to plant cultivars that perform well when young, but develop problems when older. Trees used as temporaries may tend to overbear, have weak wood or produce poor quality nuts as the trees mature. Mohawk is a good example of a temporary tree a grower may use.

## Tree Selection and Establishment

Rootstock selection can dramatically affect tree cold hardiness. Rootstocks from northern cultivars such as Peruque, or Giles or from trees native to the same area or farther to the north will produce more cold-hardy trees than trees with southern rootstocks. Orchards north of I-40 should consider using cold-hardy rootstocks to better prepare the orchard for extreme temperatures. Rootstocks can affect the scion and slow down budbreak in some years, which can help during late-spring freezes. Apache rootstocks can be used successfully in central and southern sections of the state.

Orchards can be started by planting seeds in place, growing and planting seedling trees, then grafting those one year to two years later, planting budded or grafted trees or transplanting native trees. Planting seeds in place is not recommended because of difficulties in controlling weeds, excessive tree loss and production timing.

Growing and planting seedling trees, then grafting after establishment is a satisfactory method, but delays production by several years. Some advantages include a low tree cost, availability of cold-hardy rootstocks and a wider selection of cultivars available. One year to two years after these trees

are planted, they should be grafted 18 inches or more above the soil line to improve cold hardiness of the young trees.

Planting budded or grafted bareroot trees is a common way to start an orchard. These trees cost substantially more than seedling trees; however, later labor and grafting costs may be avoided. Nursery grown trees grafted at or below the soil line decreases cold hardiness. Trees that are budded or grafted at least 18 inches above the soil line are preferred. Be sure to select cold-hardy rootstocks, if necessary. Many nursery grown trees are on southern rootstocks.

Another method has been planting seedling trees, followed by grafting in one year to two years. Both bareroot or container-grown trees are acceptable. Bareroot trees should be planted while dormant in January through March. If bareroot trees are utilized, the taproot should be trimmed to 18 inches in length, with the broken lateral roots removed and one-third to one-half of the top removed. The hole diameter should be as small as feasible to accommodate the root system, typically 6 inches to 8 inches in diameter. The hole depth should be the same as the root length to avoid the tree settling in the hole. It is critical that trees be planted at the same depth or shallower than grown in the nursery. Keep the roots moist and sheltered from the wind or freezing temperatures. Container-grown trees may be planted from October to May, but may be very susceptible to drought conditions. They may be planted without modification of the root system unless the container has caused the tap root to curl. In this case, the curled portion of the root should be removed prior to planting.

It is best to wait a year or two after planting a seedling tree to graft. Planting and grafting the same year is stressful to trees. Grafting is done in the spring when the bark starts to slip or easily peels away from the trunk, usually late April through May. Graftwood can be collected from desirable trees in the winter and stored in a refrigerator or purchased from suppliers.

Fact Sheet HLA-6207, *Starting Pecan Trees*, provides details for growing seedlings and for planting pecan trees. For grafting information, consult Fact Sheet HLA-6217, *Collecting and Storing Pecan Propagation Wood;* HLA-6204, *Bark Grafting Pecans;* and HLA-6230, *Four-flap Grafting of Pecans*. A graftwood source list, as well as a pecan nursery listing is available online at okpecans.okstate.edu or from a local county Extension office.

## Managing the Orchard Floor

The most commonly used orchard floor management system at this time is a combination of vegetation-free strips managed with herbicides beside the tree rows and sod middles between rows. This system has proven very successful in pecan orchards. A mulch layer 4 feet to 6 feet on either side of the tree and 4 inches to 6 inches deep promotes tree growth, especially in the first two to three years after planting. The mulch conserves moisture and controls weeds that compete with the trees. Wood chips, straw or other organic material can be used as mulch. Many growers also graze cattle in pecan orchards after trees are at least 12 feet tall. With grazing is becoming more difficult with the increased restrictions involving pesticide use. Current Report CR-6242, *Weed Control in Pecans, Apples, and Peaches,* describes some options for growers. Also, Fact Sheet HLA-6208, *Improving Native Pecan Groves,* presents a few orchard floor management strategies.

## Irrigating the Young Orchard

A new orchard should be watered when planted to reduce tree loss and increase tree growth, promoting earlier production. Trees should be watered in well at planting, then irrigated weekly if there is adequate rainfall during the growing season. It is important to keep the developing root zone moist for the first few years. Trees of nut-bearing age need water at several key times: during the spring for vigorous shoot growth, from May through July for nut sizing and, most importantly, from August to October for nut filling. One inch to two inches of water per week may be needed during the heat of the summer. Drip, trickle or micro-sprinkler irrigation works well in establishing orchards. Growers also have used sprinklers and traveling gun systems successfully in established orchards. Fact Sheet BAE-1511, Drip Irrigation Systems gives some good background information

There are several types of tools to assist with soil moisture monitoring and irrigation scheduling. The Irrigation Planner provided by Oklahoma Mesonet helps growers calculate water balance for each Mesonet location. This shows the amount of water a grower should apply since the last irrigation by using evapotranspiration rates and rainfall versus water usage of the pecan tree throughout the season. Tensiometers and gypsum block sensors measure soil moisture and allow growers to install in the orchard at different depths to see when the pecan trees are using water and how long irrigation is needed. These tools measure soil tension; dryer soils equal more tension or higher readings, while wetter soils have less tension and lower readings.

## Pest Control

Non-bearing trees need protection against leaf-eating insects and foliar diseases until production begins. Aphids, fall webworms, walnut datana and other foliage feeders should be monitored and controlled before serious damage occurs. Pecan scab may need to be controlled in susceptible cultivars. Current Report CR-6209, *Pecan Insect & Disease Control* gives times to spray, materials labeled for use and other helpful information when dealing with pests.

## Fertilization

After growth begins in the spring, apply nitrogen fertilizer as recommended in Fact Sheet HLA-6232, *Fertilizing Pecan and Fruit Trees*. Young, rapidly growing trees will require several foliar zinc applications a year and details the proper procedure for collecting leaf samples for nutrient analysis. Annual leaf analysis is extremely important in determining proper nutrient concentrations in the orchard.

## Training

Fact Sheet HLA-6245, *Training Pecan Trees* details the steps to build the proper framework needed to support future wood growth, heavy croploads and endure weather with minimum breakage. Training should begin at planting.

### Extension Pecan Publications

| | |
|---|---|
| HLA-6200 | A Calendar for Pecan Growers |
| HLA-6201 | Pecan Varieties for Oklahoma |
| HLA-6207 | Starting Pecan Trees |
| HLA-6232 | Fertilizing Pecan and Fruit Trees |
| HLA-6217 | Collecting and Storing Pecan Propagation Wood |
| HLA-6204 | Bark Grafting Pecans |
| HLA-6230 | Four-flap Grafting of Pecans |
| CR-6209 | Pecan Insect & Disease Control |
| CR-6242 | Weed Control in Pecans, Apples, and Peaches |
| HLA-6245 | Training Pecan Trees |
| HLA-6208 | Improving Native Pecan Groves |
| HLA-6250 | Use of Legumes in Pecan Orchards |
| HLA-6251 | Pecan Crop Load Management |
| BAE-1511 | Drip Irrigation Systems |

## SQUARE PLANTING PLAN

*Initial planting 40' x 40' (27 trees/acre)*

P 1 P 1 P 1

1 2 1 2 1 2

P 1 P 1 P 1

1 2 1 2 1 2

P 1 P 1 P 1

1 2 1 2 1 2

*First thinning about 16-22 years (14 trees/acre)*

P P P

2 2 2

P P P

2 2 2

P P P

2 2 2

*Final thinning about 25-30 years 80' x 80' (7 trees/acre)*

P P P

P P P

P P P

## TRIANGLE PLANTING PLAN

*Initial planting 40' x 40' (27 trees/acre)*

P P P

2 2 2

1 1 1

1 1 1

P P P

2 2 2

1 1 1

1 1 1

P P P

2 2 2

*First thinning about 16-20 years (14 trees/acre)*

P P P

2 2 2

P P P

2 2 2

P P P

2 2 2

*Final thinning about 30-40 years 80' x 80' (7 trees/acre)*

P P P

P P P

P P P

P = Permanent tree; 1 = removed at first thinning; 2 = removed at second thinning

**Figure 1.**



Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director of Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President, Dean, and Director of the Division of Agricultural Sciences and Natural Resources and has been prepared and distributed at a cost of 000 cents per copy.